Yoga-Induced Myositis Ossificans Traumatica of the Scapholunate Ligament

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Abstract

Background Myositis ossificans traumatica (MOT) involves the heterotopic development of lamellar bone after a traumatic injury. Despite being termed "myositis," MOT is not limited to muscle but rather can involve tendons, fat, and fascia. "Traumatica" reflects that lesions are usually associated with a history of significant trauma, that is, fractures or surgery; however, many reports suggest they can also be linked to repetitive low-energy insults. In both cases, the inflammatory response secondary to tissue injury generates a proliferative osteoblastic cascade.

Case Description We present a case of persistent wrist pain in a 43-year-old woman associated with yoga activities. Her radiographic studies demonstrated partial scapholunate (SL) ligament tear and an associated mass lesion. Surgical pathology revealed MOT involving the SL ligament.

Literature Review MOT lesions in the upper extremity are usually localized around the elbow, and cases in the hand are relatively rare. There are no prior reports of occurrences within the wrist joint or in association with the SL ligament. However, biomechanical studies have quantified significant mechanical strains across the SL interval during various yoga poses. This pattern of microtrauma is capable of generating MOT.

Clinical Relevance Upper extremity weight-bearing positions are common in yoga and subject the wrist, especially the SL interval, to high mechanical strains. This pattern of microtrauma should lead the clinician to suspect MOT when encountering a mass in the wrist, but malignancy and infection must be ruled out.

Keywords
- heterotopic ossification
- myositis ossificans traumatica
- scapholunate ligament
- wrist
- yoga

Myositis ossificans traumatica (MOT) is a form of induced heterotopic ossification (HO), defined as ectopic proliferation of lamellar bone in soft tissues after injury.[1] Although predominantly occurring in muscles, the ossifying lesion can affect any type of soft tissue, including subcutaneous fat, tendons, fascia, and nerves.[2] The pathophysiology of MOT is poorly understood but is believed that the dysregulation of local stem cells in response to tissue injury and inflammation leads to the inappropriate differentiation of fibroblasts into osteogenic cells.[2]

The history of presentation of MOT is variable. The lesion is often associated with direct high-energy trauma;[1] however, repeated minor injury has also been reported to lead to MOT. This is observed in horseback riders and skeet shooters who sustain repetitive soft tissue contusions.[2]

MOT lesions present clinically with pain, swelling, and loss of motion at joints.[1] These symptoms mimic a broad differential of pathologies, including hematoma, abscess, and soft tissue tumors. Therefore, suspected HO must still be carefully worked up to rule out such malignant and destructive processes.

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Radiologic evaluation by plain radiographs usually demonstrates a heterogeneous radio-opacity; however, the ectopic bone may be difficult to visualize in early stages due to incomplete ossification. Ultrasound has been advocated to distinguish MOT from some soft tissue tumors.[3] Definitive diagnosis is based on histology showing mature lamellar bone with fibroblasts and osteoid matrix organized around a central focus of acellular tissue.[4]

In the upper extremity, MOT lesions occur primarily near the elbow, and presentations in the hand and wrist are uncommon.[4] We report a rare case of atraumatic MOT involving the scapholunate (SL) ligament in a middle-aged woman who practices yoga regularly. In addition, we provide a clinical review of upper extremity MOT and describe the biomechanical effects of yoga exercise on the hand and wrist.

Case Description

A 43-year-old, right-hand-dominant, woman presented to the outpatient hand clinic for right wrist pain without antecedent trauma. She described pain for 3 to 4 years, minimal at rest, but aggravated by gripping, pushing, pulling, and twisting activities and particularly in forced hyperextension during yoga. She had participated in yoga activities for 10 years, averaging two to three times per week.

On physical examination, the patient demonstrated tenderness over the SL interval and ~30% reduced wrist range of motion compared with her contralateral side. Watson's test and the shuck test did not elicit symptoms of pain or instability. Plain radiographs including anteroposterior, lateral, and oblique and bilateral clenched-fist views were negative for SL interval widening but demonstrated a radio-opacity at the dorsal wrist (►**Fig. 1**).

The patient was referred for magnetic resonance arthrogram to further evaluate the SL ligament, which revealed extravasation of contrast into the SL interval consistent with partial tear of the SL ligament. In addition, a poorly defined ovoid structure measuring 3 × 4 mm was observed dorsal to the SL interval (►**Fig. 2**). Patient was counseled for wrist arthroscopy with coblation versus continued observation with symptom management. Given the chronicity of her symptoms, the patient elected for surgical management.

A partial tear involving the inferior SL ligament was confirmed with diagnostic wrist arthroscopy. The frayed edges were coblated using the Arthrex ArthroCare device. Dynamic intraoperative fluoroscopy verified that the SL ligament remained stable, allowing scaphoid and lunate to move as one unit.

Subsequently, a dorsal incision was made over the SL interval and dissection performed between the third and fourth extensor compartments to reveal a heterotopic mass measuring 0.8 cm in diameter, arising from the dorsal SL ligament. The mass was carefully excised. The patient also demonstrated severe synovitis involving the extensor mechanisms of digits 2 to 5, which was debrided. Intraoperative imaging confirmed complete removal of the dorsal wrist mass. Dorsal joint capsule and all skin incisions were closed, and the patient splinted in a neutral position. The excised mass and synovial specimens were sent for pathologic analysis.

There were no postoperative complications. The patient was transitioned into a removable wrist splint at 1 week and motion initiated at 2 weeks postoperatively. With formal hand therapy, the patient's range of motion and strength at her 8-week follow-up were comparable to baseline. At 2-year clinical follow-up, the patient continued to do well without evidence of symptom recurrence.

Pathology of the specimen revealed reactive osteocartilaginous tissue, consistent with HO (►**Fig. 3**). All synovial samples were consistent with reactive synovial hyperplasia.

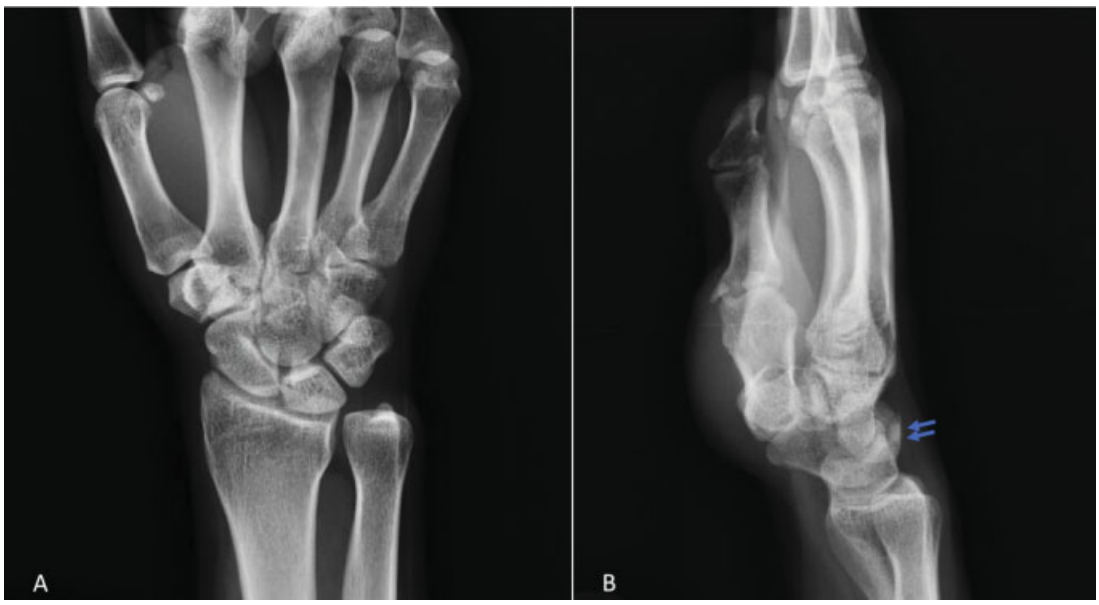

Fig. 1 (**A-B**) Anterior-posterior and lateral wrist radiographs, with arrows indicating dorsal wrist mass.

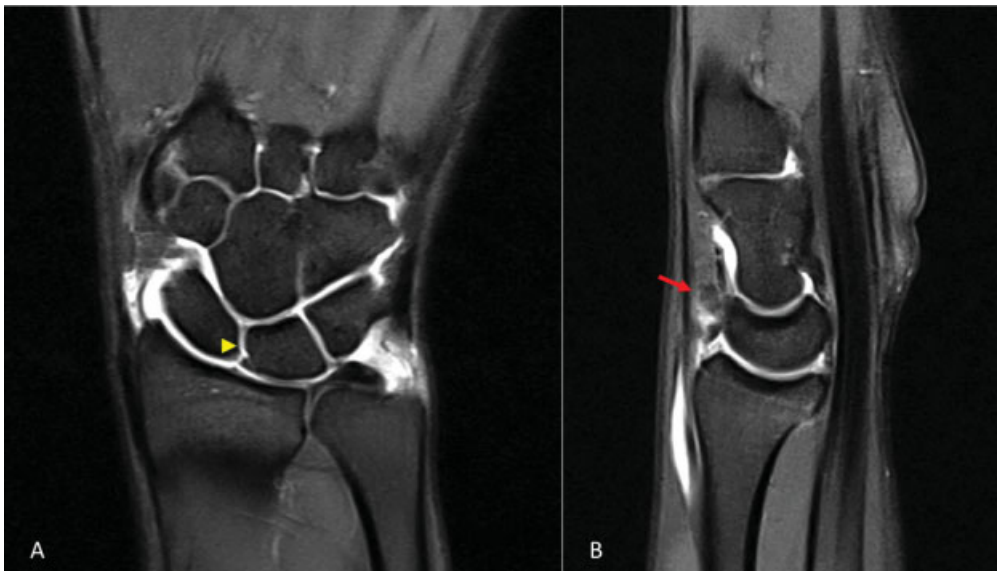

Fig. 2 MR arthrogram of the wrist with coronal (**A**) and sagittal (**B**) T2-weighted sequences, arrowhead indicating partial scapholunate tear, arrow indicating dorsal wrist mass.

Discussion

This case of MOT is unique for its location within the dorsal wrist joint capsule and for its inciting activity—yoga.

Even though MOT can occur in any bodily tissue, the majority of upper extremity cases are localized to the elbow and reports in the hand are rare. Akahane et al described a case of a heterotopic mass occurring in the thenar musculature of a 14-year-old girl, at first suspected of being an osteoblastic malignancy.[5] An isolated lesion occurring at the tip of the thumb has also been reported.[6] This is the first report in the literature of MOT occurring intracapsulary at the SL interval.

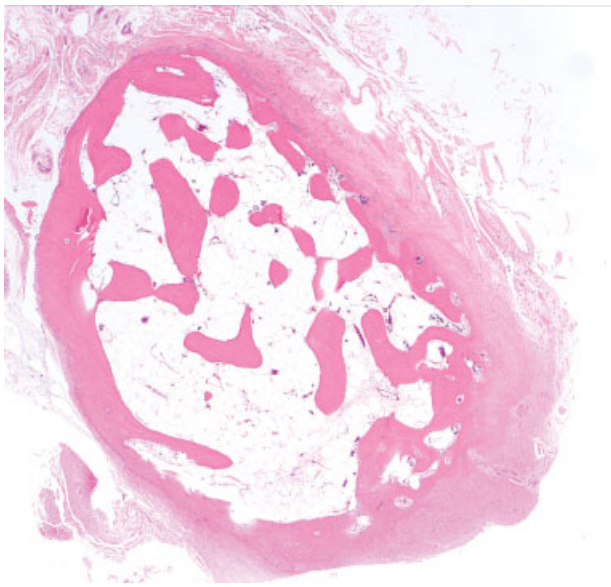

Fig. 3 Surgical pathology of excised mass demonstrating osteocartilaginous tissue with acellular core, consistent with heterotopic ossification.

The pathophysiology of MOT suggests that it is a dysregulated proliferative response to soft tissue injury. Lesions typically occur after direct trauma such as fractures or surgery; however, repetitive low-energy insults can also lead to MOT. For example, horseback riders develop MOT in their adductor muscles ("rider's bone") and skeet shooters and hunters get similar deltoid lesions ("shooter's bone") due to minor, but repetitive, soft tissue contusions.[2] Thorough interview of this patient did not reveal any obvious injury to her hand or wrist; however, her hobby of yoga presents a potential source of repetitive microtrauma. In our literature review, only one other case of MOT associated with yoga occurring was reported involving the forearm musculature.[7]

A recent survey suggests 11.5% of yoga injuries involve the wrist.[8] Many poses in yoga, such as downward dog, Chaturanga, and side planks, place the wrist in hyperextension, ulnar deviation, and carpal supination. This position predisposes to injury of the SL ligament[9] because axial loads generate 29% more strain through the SL interval when the wrist is in extension compared with a neutral wrist position.[10] Biomechanically, the dorsal SL ligament is the primary stabilizer of the SL interval with yield strength of 260.3 N. The palmar and proximal ligaments contribute 117.9 N and 62.7 N, respectively.[11] Klifto et al evaluated three common yoga poses for the force they transmit through the SL interval. Side planks transmit a force of 433 N, followed by Chaturanga at 290 N and downward dog at 250 N.[8]

We hypothesize that our patient developed a partial SL ligament tear, secondary to the high repetitive forces applied to the wrist during yoga. Over 3 years, the continued microtrauma created an environment of chronic inflammation that likely lead to the development of MOT of the SL ligament. The progression of patient symptoms over time is likely secondary to mechanical impingement of the dorsal wrist lesion and worsening tenosynovitis.

Up to 80% of HO cases are benign with no complications.[4] For the minority associated with symptomatic loss of motion, pain, and/or neuropathy, a trial of conservative management with nonsteroidal anti-inflammatories and activity modification is recommended prior to operative intervention. With surgical intervention, the goal is for complete resection while preserving anatomic function and restoring joint motion. Timing of excision may be possible as early as 3 months for elbow lesions,[12] with no difference in recurrence compared with traditional recommendations of waiting 1 to 2 years until the lesion is completely matured.[4]

In summary, this is a rare case of a 43-year-old woman with MOT of the dorsal SL interval. Careful evaluation of any new mass lesion should be performed to rule out infection and malignancy. MOT within the wrist may be suspected if the patient has a history of repetitive microtrauma, such as yoga exercise.

Conflict of Interest
None.

References

1 Kaplan FS, Glaser DL, Hebela N, Shore EM. Heterotopic ossification. J Am Acad Orthop Surg 2004;12(02):116–125
2 Walczak BE, Johnson CN, Howe BM. Myositis ossificans. J Am Acad Orthop Surg 2015;23(10):612–622
3 Abate M, Salini V, Rimondi E, et al. Post traumatic myositis ossificans: Sonographic findings. J Clin Ultrasound 2011;39(03):135–140
4 Mavrogenis AF, Soucacos PN, Papagelopoulos PJ. Heterotopic ossification revisited. Orthopedics 2011;34(03):177
5 Akahane T, Mori N, Nakatsuchi Y. Myositis ossificans occupying the thenar region: a case report. J Med Case Reports 2015;9:105
6 Goto H, Hatori M, Kokubun S, Makino M. Myositis ossificans in the tip of the thumb: a case report. Tohoku J Exp Med 1998;184(01):67–72
7 Kohanzadeh S, LaFrenierre S, Nasseri Y, Silberman A, Kulber D. Myositis ossificans of the forearm after yoga. Am Surg 2012;78(08):E361–E363
8 Klifto C, Sapienza A, Pt SR, Posner M. Wrist biomechanics in yoga. J Hand Surg Am 2015;40(09):e33
9 Mayfield JK, Johnson RP, Kilcoyne RK. Carpal dislocations: pathomechanics and progressive perilunar instability. J Hand Surg Am 1980;5(03):226–241
10 Upal MA, Crisco JJ, Moore DC, Sonenblum SE, Wolfe SW. In vivo elongation of the palmar and dorsal scapholunate interosseous ligament. J Hand Surg Am 2006;31(08):1326–1332
11 Berger RA, Imeada T, Berglund L, An KN. Constraint and material properties of the subregions of the scapholunate interosseous ligament. J Hand Surg Am 1999;24(05):953–962
12 Chen S, Yu SY, Yan H, et al. The time point in surgical excision of heterotopic ossification of post-traumatic stiff elbow: recommendation for early excision followed by early exercise. J Shoulder Elbow Surg 2015;24(08):1165–1171